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(54) Improvements in and relating to preserving food products

(57) A process for preserving a food product 1 that increases in volume when heated comprises enclosing the food product in a package 2 comprising a tray 3 and a cover 4 of flexible material arranged over the mouth 3c of the tray and spaced apart from the food product, the package having a microporous window 5 and 6. The food product 1 in the package 2 is heated to effect pasteurisation and, if desired, cooking of the food product, and the package is sealed. The cover 4 and the microporous window 5 and 6 are so arranged, and of such an area, relative to the tray 3 and the food product 1 that, before the package 2 is sealed, gas can only enter or leave the interior of the package through the microporous window and, during heating, in spite of an increase in volume of the food product, the cover remains spaced apart from the food product and, during subsequent cooling, moves towards the food product. The cover may take the form of a pouch (Fig. 12).

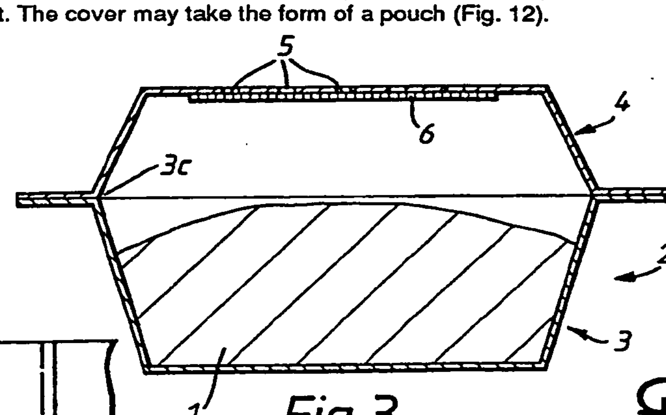

Fig.3.

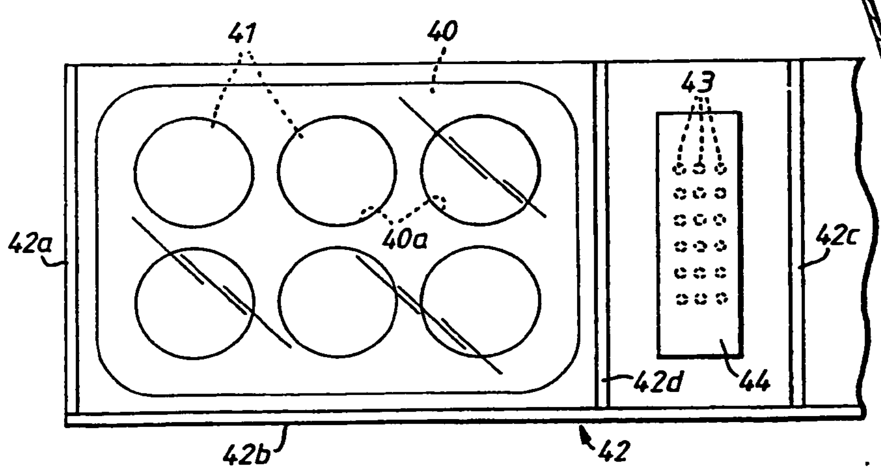

Fig.12.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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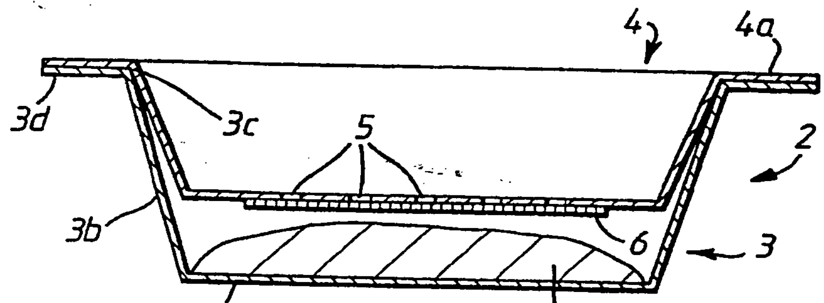

Fig. 1.

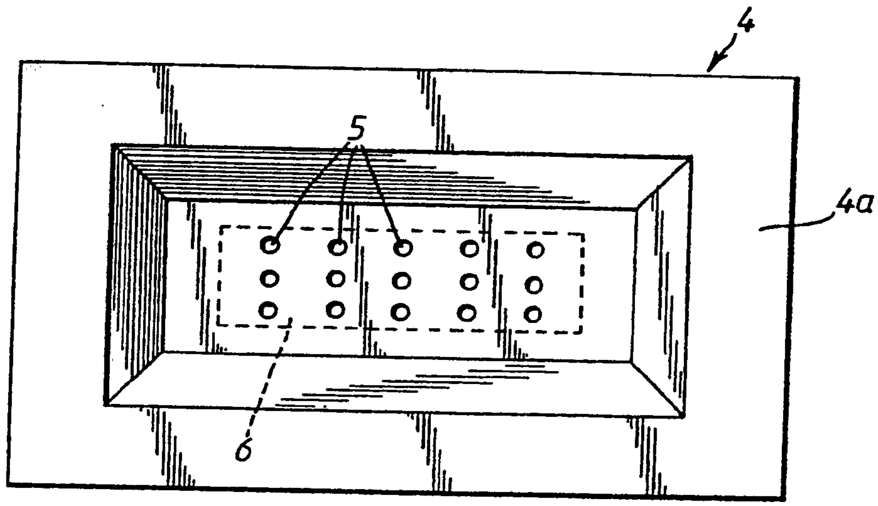

Fig. 2.

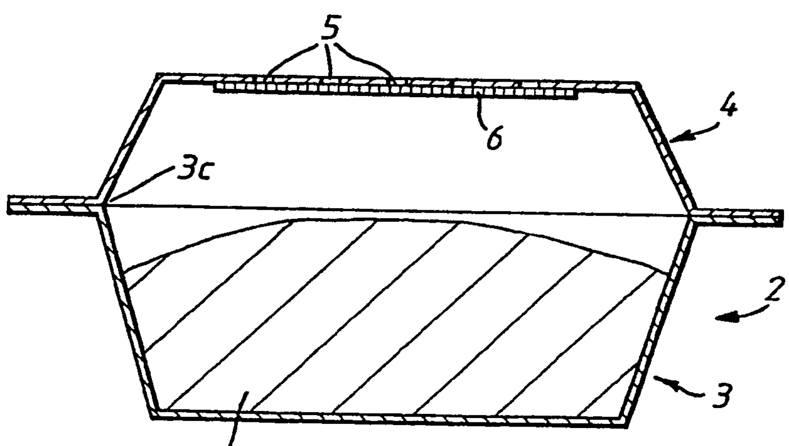

Fig. 3.

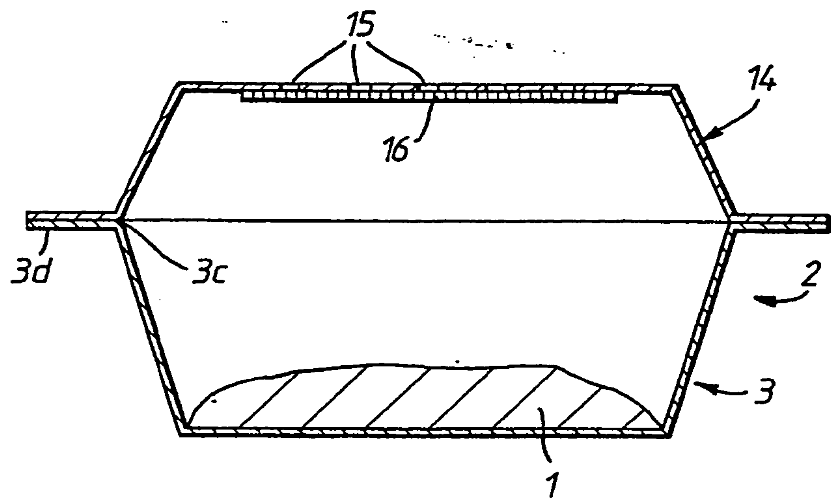

Fig. 4.

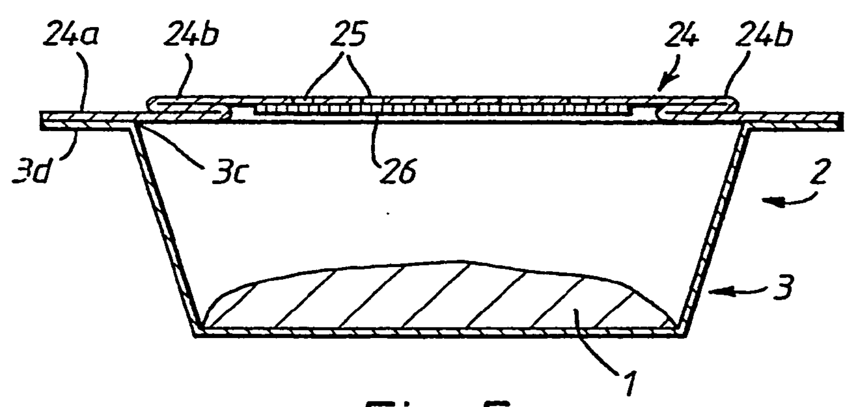

Fig. 5.

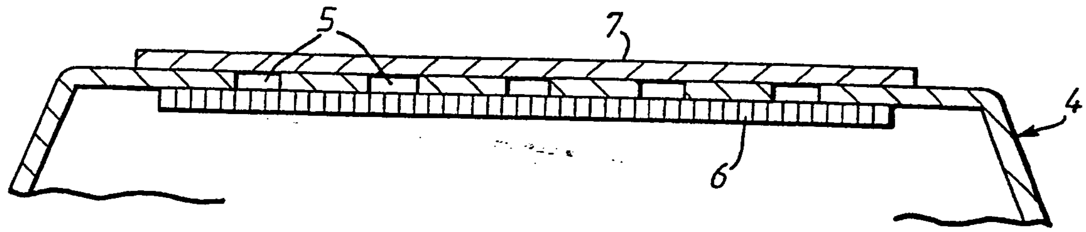

Fig. 6.

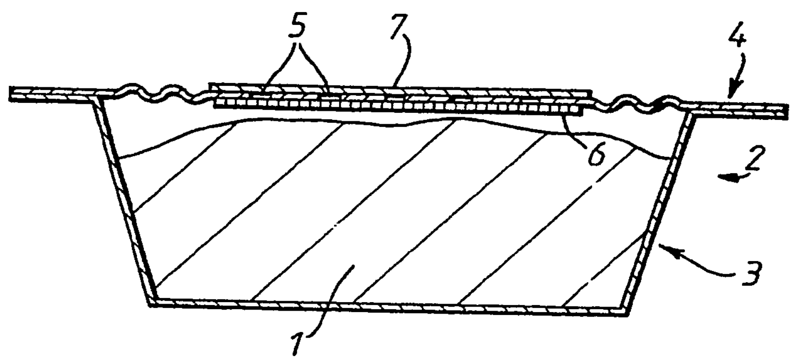

Fig. 7.

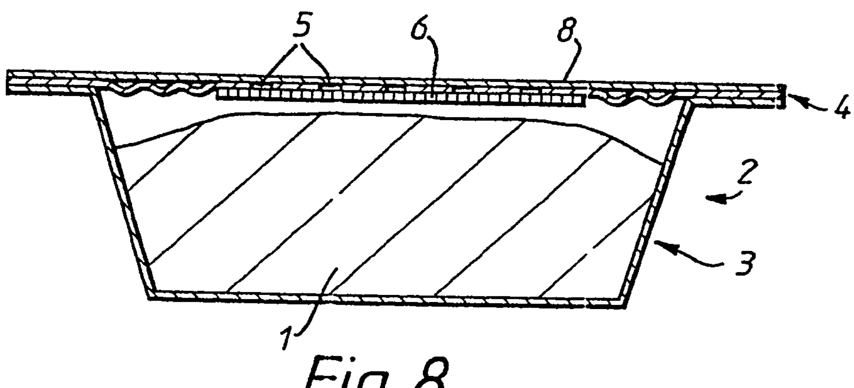

Fig. 8.

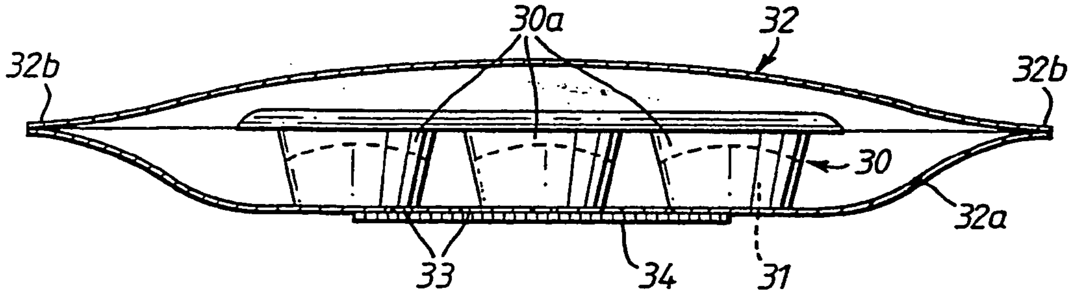

Fig. 9.

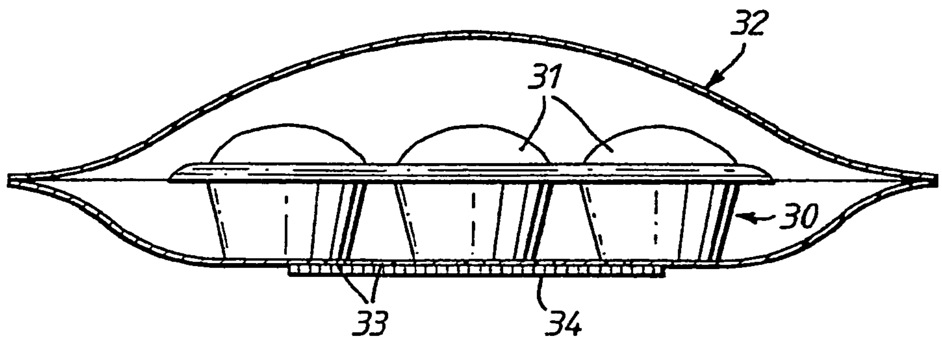

Fig. 10.

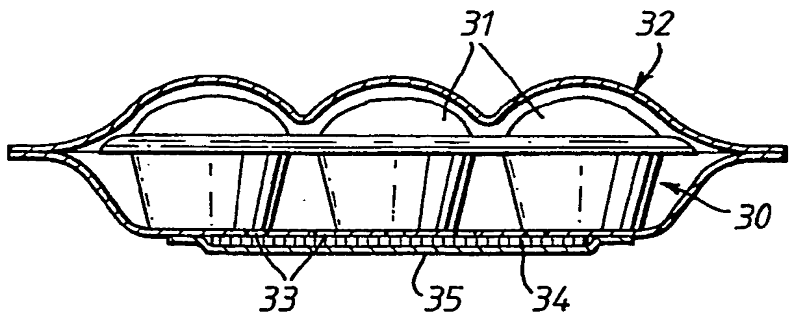

Fig. 11.

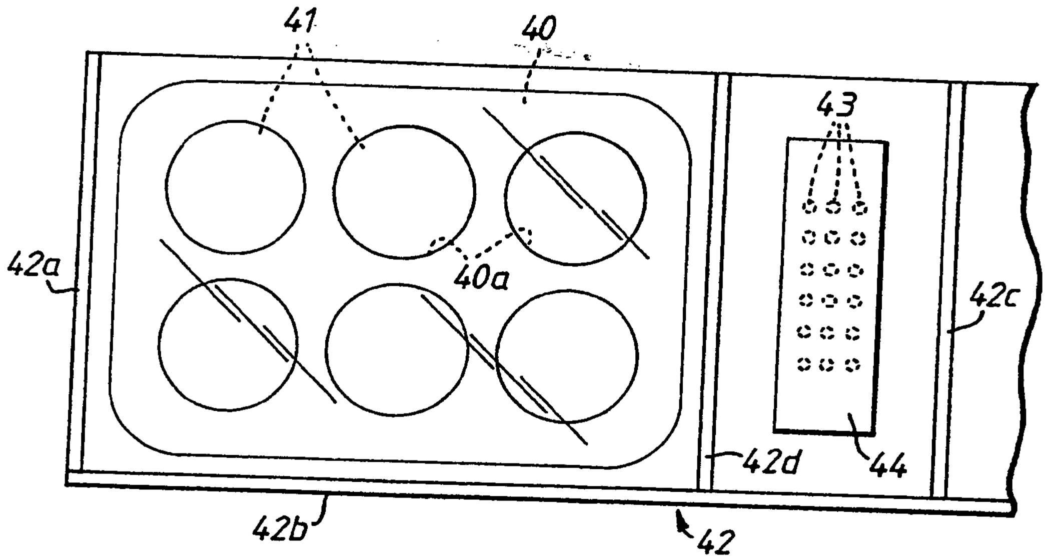

Fig.12.

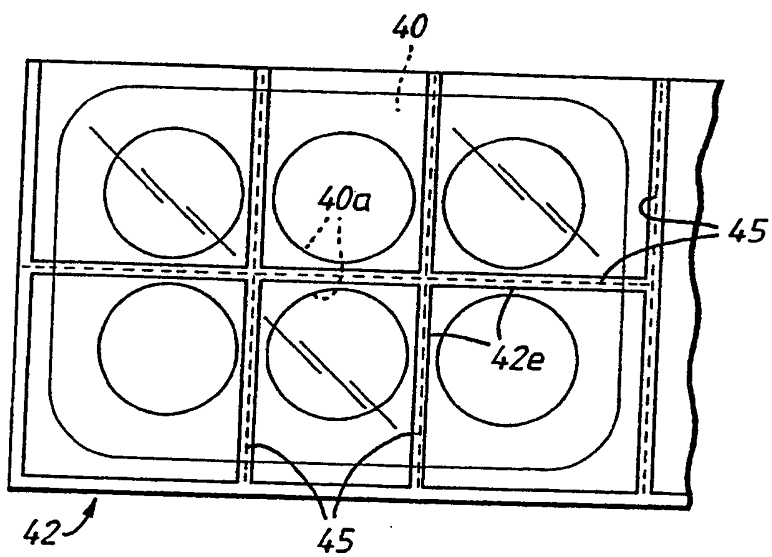

Fig. 13.

"Improvements in and relating to preserving food products"

This invention relates to preserving food products and to sealed packages containing such preserved food products.

The term "preserving" is used throughout the specification to mean so treating a food product as to increase the period of time for which that food product will remain substantially unimpaired by vegetative micro-organisms as compared with the period of time for which it would have remained so unimpaired under the same storage conditions had it not been so treated.

The preserving of moist baked foods, for example, bread and cake, gives rise to particular problems. Baking itself suffices to preserve the food products to some extent in addition to effecting cooking. That is because baking brings the temperature of the food ingredients, and of the cooked product, to a level at which vegetative micro-organisms are destroyed. The destruction of vegetative micro-organisms that are responsible for most food spoilage begins when the temperature rises above 65°C.

Many products that have simply been formed by baking appropriate ingredients, however, do not remain unspoilt for very long unless further steps are taken. There are several reasons for that: the moisture content of the product may change undesirably, the product may become re-infected by vegetative micro-organisms, and there are

two groups of bacteria that produce heat-resistant spores that survive the heat treatment inherent in baking.

Undesired changes in moisture content can be avoided by enclosing the product in a sealed package. For various reasons, however, the product usually has to be allowed to cool before packaging. For example, the product may be fragile while it is hot and condensation may occur within the package if it is sealed before cooling of the product. During cooling, the product is liable to re-contamination unless steps are taken to prevent it.

Spoilage resulting from the heat resistant spores can, as is known, be controlled in various ways, for example, by restricting the water activity of the product and by maintaining a high acidity of the product, each of which can be applied only to a restricted range of products. Also, spoilage can be controlled by storing the product under a suitable atmosphere, for example, an atmosphere containing only a small proportion of free oxygen and, especially, an atmosphere containing a high proportion of carbon dioxide. Further, spoilage can be controlled by storing the product at temperatures lower than the ambient temperature.

It has previously been proposed (see European Patent Application No. 368 601 A2) to prevent re-contamination of the product during cooling by closing the mouth of a tray in which the product is located, before heating, with a layer of a microporous material, which may be

paper or a plastics material and which, while permitting the egress of gas (for example, air and water vapour) and the ingress of gas (for example, carbon dioxide), substantially prevents the ingress of micro-organisms. When the product has been cooled, the tray is sealed by enclosing it within a gas-proof envelope.

In some cases, however, there is an additional problem in that, with some products, of which bread is an example, the product may increase in volume or "rise" on heating. It is undesirable for the product to come into contact with a covering layer of microporous material at that stage because the microporous material may become contaminated with the food product, which might block the pores of the material and impair its effectiveness, and on which mould spores might germinate. Also, the appearance of the food product itself might be spoilt by such contact.

The invention provides a process for preserving a food product that increases in volume when heated, which comprises enclosing the food product in a package comprising a tray, in which the food product is located, and a cover of flexible material arranged over the mouth of the tray and spaced apart from the food product, the package having a microporous window (as hereinafter defined), heating the food product in the package to effect pasteurisation and, if desired, cooking, of the food product, and sealing the package, the cover and the microporous window being so arranged, and of such an

area, relative to the tray and the food product that, before the package is sealed, gas can only enter or leave the interior of the package through the microporous window and, during heating, in spite of an increase in volume of the food product, the cover remains spaced apart from the food product and, during subsequent cooling, moves towards the food product.

The term "microporous window" is used throughout the specification to mean a region of the package having pores or perforations of such a size that gases can pass through the window but micro-organisms are substantially prevented from doing so. The microporous window may comprise a single opening or two or more openings in the cover or the tray, for example, an array, which may be regular or irregular, of punched holes, and a patch of microporous material closing the opening or openings, (the openings being much larger than the pores in the microporous material). Alternatively, the microporous window may be a region of the cover or the tray that has perforations in it of the said size.

During heating, gases, for example, water vapour, are evolved by the food product and there is thermal expansion of the atmosphere in the package. By having a microporous window located in the cover or in the tray of the package (or in both the cover and the tray) it is possible to allow gases to escape from the interior of the package through the window and also to prevent micro-organisms from entering the package. By suitably

selecting the area and porosity of the window it can be readily arranged for the window to offer such resistance to the flow of gas through it that a significant pressure difference develops across it during heating. In the process of the invention, that pressure difference is used to ensure that the cover, which is flexible, does not come into contact with the food product during heating even though the food product increases in volume. On cooling, the gas pressure within the package decreases to the ambient pressure and may in some cases decrease below the ambient pressure. Thus, the cover moves towards the food product so that the final, cooled product appears substantially to fill the package.

The cover may be affixed, for example, mechanically or by heat-sealing, to the tray itself around the mouth of the tray, the part of the cover bounded by its join to the tray being of greater area than the mouth of the tray. (Such a cover will be hereinafter referred to as a "lid".)

The lid may be so arranged that it extends down into the tray before heating (although it is still spaced apart from the food product) and, during heating, rises, because of the pressure difference across it, to form a dome over the food product. In another arrangement, the lid may be folded, pleated, or preformed and collapsed, so that it lies substantially in the plane of the top of the tray before heating and, during heating, rises to form a dome over the food product. In a further

arrangement, the lid may have a generally domed configuration before heating. In that case, the pressure difference is not required to cause the lid to rise but, because of the flexibility of the lid, it is still necessary to ensure that it is maintained in its domed configuration by the pressure difference across it. Also, in that case, it is necessary to arrange that the gas pressure within the package decreases below the ambient pressure during cooling so that the lid moves towards the food product. The lid may be arranged in the desired configuration by thermoforming, pressure-forming or moulding before it is affixed to the tray.

Sealing of such a package comprising a tray and a lid as described above may be effected before any substantial cooling of the food product has occurred by placing over the window a sealing layer of moisture-impermeable material (by which is meant a material having a relatively high resistance to the passage of moisture) and affixing the sealing layer. When the window is located in the lid (and it will usually be found more convenient for the window to be located in the lid than in the tray) and sealing is to be effected in such a manner, then, advantageously, the porosity and the area of the window, the nature of the food product and the baking temperature are such that, at or before the completion of the heating step, the lid is, over an area that includes the window, upheld with sufficient force by the excess gas pressure within the package over the

ambient pressure to enable the sealing layer to be affixed to the lid, by heat-sealing or by means of an adhesive, by pressing the sealing layer downwards on the lid without causing the lid to come into contact with the food product. Such a sealing step can be performed relatively easily before the tray leaves the oven. It will generally be found that a microporous window of the porosity capable of performing its primary purpose of substantially preventing the ingress of vegetative micro-organisms and of convenient area will afford sufficient resistance to the flow of gas through it, not only to ensure that the lid does not come into contact with the food product during baking, but also to cause the lid to be adequately supported by gas pressure during such a sealing step.

In an arrangement in which the microporous window is in the lid, the sealing layer may be sealed to the lid over an area surrounding the window before any substantial cooling of the food product has occurred, and, after cooling, when the lid has moved towards the food product, the said layer affixed to the tray, or to the lid where it is supported by the tray. In such a case, the sealing layer may be in the form of a sheet of semi-rigid plastics material or board. An arrangement in which sealing is carried out before any substantial cooling of the food product has occurred has the advantage that the contacting surfaces of the microporous window, the lid and/or tray, and the sealing layer are generally

microbiologically clean when the surfaces are brought into contact, because of the relatively high ambient temperature and the presence of water vapour arising from the heating step.

Instead of the above arrangement for sealing the package, the food product may be allowed to cool and the package sealed after the flexible lid has moved towards the food product by placing over the microporous window a sealing layer of moisture-impermeable material at that stage and then affixing the sealing layer to the lid and/or tray. In such a step, the sealing layer may be affixed to the lid and/or tray by means of a pressure-sensitive or heat-activated adhesive, or by heat-sealing the sealing layer to the lid and/or tray. Any contact between the lid and the food product after baking and cooling is much less likely to spoil the appearance of the food product or cause other undesirable effects than contact between the lid and the food product before, or during, baking. The sealing layer may, again, be in the form of a sheet of semi-rigid plastics or board. In any such case in which the food product is allowed to cool before sealing, the sealing layer may have incorporated in it an antimycotic agent to help guard against re-contamination by vegetative micro-organisms. Instead, or in addition, immediately prior to sealing, the surfaces of the lid and/or tray and the microporous window that are to be contacted by the sealing layer may be heated to a temperature of at least 80°C in order to inhibit

germination of any mould spores which may have fallen on those surfaces during cooling of the food product. Such heating may be carried out using infra red radiation, or it may be carried out by drawing the surfaces onto a hot plate by evacuating the region between those surfaces and the hot plate. The sealing layer is advantageously also heated prior to use. Instead of, or in addition to, heating to inhibit the germination of mould spores, ultra-violet radiation may be used for that purpose.

In a further arrangement, sealing may be carried out by placing the tray with its contents and lid in a moisture-impermeable overwrap, which may be a bag or other form of container.

The sealing step may, if desired, be carried out in an atmosphere containing only a small proportion of free oxygen, and it may be carried out in an atmosphere of an inert gas, for example, nitrogen or carbon dioxide, which latter gas has a preservative effect on the food product by inhibiting the growth of micro-organisms. In such a case, before sealing, there may be an exchange of gases within the package for ambient gases through the micro-porous window.

The final position of the flexible lid relative to the tray after the food product has finished cooling will depend upon the area of the part of the lid bounded by its join to the tray in relation to the size of the tray, the nature and amount of the food product, and the temperature when the package is sealed and the temp-

erature when it has finished cooling. It may be preferable, in order to facilitate stacking of the filled and sealed packages, for example, to arrange that, when the food product has finished cooling, the lid lies substantially in the plane of the top of the tray. It will be appreciated that the lid will not necessarily be flat, and may be wrinkled.

The tray may be of such configuration that it has a base and side walls that extend round the base of the tray (the term "side walls" being used throughout the specification to include a single, continuous wall extending right round the base), the food product being placed on the base of the tray. The tray may, however, instead, be of such configuration that it defines a plurality of cavities for the food product, and that will be referred to as a "multi-cavity configuration". Such a multi-cavity configuration may be provided by using a tray having a base and side walls as described above and a lining situated within the tray, the lining being so shaped as to define the cavities. The multi-cavity configuration tray may, however, be a single unit. In either case, the term "mouth of the tray" as used in the specification then refers to an area that encompasses the mouths of all the cavities.

The lid may be a sheet of flexible material, which may be affixed to the tray in the form of a continuous web, and thereafter severed.

Instead of the cover being affixed to the tray in

the form of a lid, the cover may be a pouch in which the tray is situated, the microporous window being located in the pouch.

Sealing of the pouch may be effected after the food product has cooled by covering the microporous window with a sealing layer of moisture-impermeable material and affixing the sealing layer to the pouch to effect the seal. Alternatively, the pouch may be enclosed in an over-wrap of moisture-impermeable material, which is then sealed. In either case, to guard against re-contamination by vegetative micro-organisms, the sealing layer or the over-wrap may have incorporated in it an antimycotic agent, and/or the outer surface of the pouch and the inner surface of the sealing layer or over-wrap may be heated, immediately prior to sealing, to a temperature of at least 80°C, or treated with ultra-violet radiation as described in the sealing step above.

When the cover is a pouch, the microporous window may be so located in the pouch that it is directly over the mouth of the tray, but, rather than having the window over the mouth of the tray, it may be found advantageous for it to be so located in the pouch that it is underneath the tray. Preferably, the microporous window is so located in the pouch relative to the tray that opposing surfaces of the pouch can be affixed to each other to isolate the food product from the window, and thereby seal the tray in a moisture-impermeable enclosure provided by a portion of the pouch. In the latter case, no

additional sealing layer need be provided and the portion of the pouch containing the microporous window is preferably removed after sealing.

When the tray is of multi-cavity configuration, the pouch may be sealed to the tray around the mouth of each of the cavities, especially when the microporous window is not located over the mouths of the cavities. Such a tray may also be formed with lines of weakness around each of the cavities so as to allow portions of the tray, each comprising one of the cavities, to be separated easily from each other.

The materials used for the tray, the cover (whether it is in the form of a lid or a pouch), the patch of microporous material (when provided) and the sealing layer, if a sealing layer is used before cooling, must all be capable of withstanding the full baking temperatures, for example, temperatures in the range of from 180°C to 240°C. In addition, the microporous patch should also be affixed to the cover or the tray, whichever the case may be, in a manner such that the resulting join withstands temperatures within that range.

When the microporous window comprises a patch of microporous material, that patch may be made from medical paper or it may be made by stretching a film having mineral inclusions to give a controlled pore size, or by polymer sintering. It may also be made of a film perforated so as to permit the passage of the gases as referred to above but substantially to exclude the

passage of micro-organisms and mould spores through it. The film may be made of polyester, polycarbonate, polyether sulphones, polyether imide or other polymers.

The cover (whether it is in the form of a lid or a pouch) is advantageously made from a sheet of co-extruded oriented polyester and heat-sealable amorphous polyester, the latter material forming the inner surface of the cover. In such a case, when the microporous window is in the cover and comprises a patch of microporous material, the patch is preferably affixed to the inner surface of the cover by heat-sealing.

The tray may be made of crystalline polyester, and in an arrangement in which the cover is in the form of a lid, the tray may have, at least on that portion of the surface to which the cover is affixed, a layer of heat-sealable amorphous polyester. The tray may, instead, be made of a plastics material comprising a polyether imide and a polycarbonate, or of a thermosetting plastics material. It may also be made from a fibrous material lined with an amorphous polyester or from a thermosetting plastics material. Further, it may be made of aluminium foil having a lacquer coating.

The tray may be given the desired configuration by moulding, thermoforming or pressure-forming. In the last case, a relatively thin sheet, for example, within the range of from 20 to 30 x 10^{-6}m in thickness, of co-extruded oriented polyester and heat-sealable amorphous polyester may be placed on a male die with the amorphous

layer in contact with the die, and the sheet and the male die placed in a matching female die so as to pleat or crease the sheet into the desired configuration. By using heated dies, the pleats can be secured in place by heat-sealing the layers of the pleats together. Instead of using a single sheet of co-extruded material, two such sheets affixed to each other by means of a temperature-resistant adhesive with their amorphous surfaces outermost may be used so that better heat-sealing of the pleats can be obtained. When the tray is formed in the above manner, because it may be lacking in rigidity, it is preferably located in a rigid container during the heating step of the method of the invention.

The invention also provides a sealed package containing a food product which has been preserved by a process in accordance with the invention.

Several forms of process for preserving a food product and several forms of sealed package, all in accordance with the invention, will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic vertical section through a first form of package comprising a tray and a cover in the form of a lid;

Fig. 2 is a plan view of the lid for the tray shown in Fig. 1;

Fig. 3 is a diagrammatic vertical section through the package shown in Fig. 1, but during

baking;

Fig. 4 is a diagrammatic vertical section through a second form of package comprising a tray and a lid, before baking;

Fig. 5 is a diagrammatic vertical section through a third form of package comprising a tray and a lid, before baking;

Fig. 6 is a cross-section, on a larger scale, through a portion of the lid when the package shown in Fig. 3 (or Figs. 4 and 5) has been sealed;

Fig. 7 is a diagrammatic vertical section through the package shown in Fig. 6, after baking, sealing and cooling;

Fig. 8 is a diagrammatic vertical section through the package shown in Fig. 3 (or Figs. 4 and 5) when the package has been sealed in an alternative manner to that shown in Figs. 6 and 7;

Fig. 9 is a diagrammatic side view partly in section of a fourth form of package comprising a tray and a cover in the form of a pouch, before baking;

Fig. 10 is a diagrammatic side view partly in section of the package shown in Fig. 9, but during baking;

Fig. 11 is a diagrammatic side view partly in section of the package as shown in Fig. 10

but after cooling and sealing;

Fig. 12 is a diagrammatic plan view of a further form of package comprising a tray and a pouch, after sealing, and

Fig. 13 is a diagrammatic plan view of the form of package shown in Fig. 12 after further sealing.

Referring to the accompanying drawings, and initially to Figs. 1 and 2, a food product 1 to be baked is enclosed in a package, which is indicated generally by the reference numeral 2, comprising a tray, indicated generally by the reference numeral 3, in which the food product is located, and a cover in the form of lid, indicated generally by the reference numeral 4.

The tray 3 has a base 3a and sidewalls 3b, which define a mouth 3c and which terminate at the top in a peripheral, outwardly extending flange 3d. The tray 3 is formed of crystalline polyester with a layer of heat-sealable amorphous polyester on its inner surface (including the upper surface of the flange 3d).

The lid 4, made from a sheet of co-extruded layers of oriented polyester and heat-sealable amorphous polyester is arranged over the mouth 3c of the tray 3 with the amorphous polyester layer facing the interior of the tray. A peripheral portion 4a of the lid is affixed to the flange 3d of the tray 3 by heat-sealing the amorphous polyester layers of the lid and the tray together. The part of the lid 4 within the peripheral portion 4a is of

greater area than the mouth 3c of the tray, and the lid 4 is of such configuration that it extends down into the interior of the tray 3 leaving a small clearance between the inner surface of the lid and the uncooked food product 1.

As can be clearly seen in Fig. 2, the lid 4 is provided with a microporous window in the form of a regular array of circular apertures 5 in the lid and a patch 6 of microporous material. The size of the apertures 5 is such that the lid 4 does not itself materially impede the egress of gas from the package 2 during baking of the food product 1 even though the lid is made of an impervious material. Affixed by heat-sealing to the inner surface (the surface facing the interior of the tray 3) of the lid 4 and covering all the apertures 5, however, is the microporous patch 6, which is of such porosity that it allows gases to pass through it but substantially prevents micro-organisms from passing through it. Because the lid 4 is itself sealed to the tray 3, gases can only enter or leave the package 2 through the patch 6, and micro-organisms from the exterior are substantially prevented from entering the package, and hence from reaching the food product 1. The microporous patch 6 may be a sheet of microporous paper or a sheet of microporous plastics material.

The package 2 is placed in an oven and heated to effect pasteurisation of, and to bake, the food product 1, which increases in volume as it is heated. Gases

(principally water vapour) given off by the food product 1 during baking and the increase in pressure of the atmosphere in the package 2 resulting from the increase in temperature cause the portion of the lid 4 that is directly above the food product 1 to rise up from the tray 3 so that the lid 4 forms a dome over the food product 1 as shown in Fig. 3. Thus, the food product 1 can increase in volume considerably without coming into contact with the inner surface of the lid 4 or the patch 6. Such contact at this stage would spoil the appearance of the baked food product and contaminate the lid 4. The lid 4 rises in response to the pressure difference across it because, although the apertures 5 are not sufficiently small to impede the flow of gases, the pores in the microporous patch 6 are small enough to retard the gas flow through the apertures 5 very significantly.

Instead of a lid 4 which is arranged to extend down into the tray 3 before the food product 1 is baked as shown in Fig. 1 and which rises to form a dome over the food product during heating, a lid 14 already having a domed configuration before baking may be used as shown in Fig. 4, the lid being arranged over the mouth 3c of the tray 3 (the same reference numerals as used in Figs. 1 and 2 being used in Fig. 4 where appropriate) and being sealed to the flange 3d of the tray before the food product is heated. The lid 14 is provided with a microporous window in the form of a regular array of circular apertures 15 similar to the apertures 5 of the lid 4, and a

microporous patch 16 closing the apertures 15, the patch being heat-sealed to the inner surface of the lid 14. The pressure difference that develops across the lid 14 during baking ensures that the lid remains in its domed configuration so that there is no contact between it and the food product 1 during baking even when the volume of the food product has increased to its maximum.

In a further form of package shown in Fig. 5, a lid 24 made from a sheet of flexible material is arranged over the mouth 3c of the tray 3 (the same reference numerals as used in Figs. 1 and 2 being used in Fig. 5 where appropriate), and its peripheral portion 24a is heat-sealed to the flange 3d of the tray. The portion of the lid 24 within the peripheral portion 24a is pleated at 24b so that the lid lies substantially flat and in the plane of the top of the tray 3. The lid 24 is, like the lids 4 and 14, provided with a microporous window in the form of a regular array of apertures 25 and a microporous patch 26 closing the apertures and heat-sealed to the inner surface of the lid 24. During baking, the lid 24, like the lid 4, rises to form a dome over the food product 1 similar to that shown in Fig. 3.

Instead of a microporous window in the form of a regular array of apertures, such as the apertures 5, 15 and 25 closed by a microporous patch, such as the patches 6, 16 and 26, respectively, the microporous window may be a region of the lid 4, 14 or 24 that has perforations in it of such a size that gases can pass through but micro-

organisms are substantially prevented from doing so.

While the tray 3, and its contents and lid (which may be of any of the lids 4, 14 or 24, but will be referred to, for simplicity, as the lid 4) are still in the oven and at the full baking temperature, a sealing layer 7 of a moisture-impermeable flexible sheet material is affixed to the upper surface of the lid 4 (see Fig. 6) by heat-sealing it to the lid 4. The sealing layer 7 covers all the apertures 5 and so seals the package 2. The pressure difference across the lid 4 is sufficiently great to enable it to withstand the downward pressure on it needed to heat-seal the layer 7 to it, without the need for any other form of support, and also prevents the lid 4 or the microporous patch 6 from coming into contact with the food product 1 during the sealing step.

Because of the relatively high ambient temperature of the baking process and the presence of water vapour emitted by the food product 1, the portions of the surfaces of the microporous patch 6 and the lid 4 that are contacted by the sealing layer 7 and the surface of the sealing layer itself are microbiologically clean.

After the package 2 has been sealed as described above, it is removed from the oven and allowed to cool. The gas pressure within the package 2 decreases relative to the ambient pressure, and the lid 4 with the microporous patch 6 and the sealing layer 7 secured to it moves down towards the food product 1 and wrinkles as shown in Fig. 7, so that it lies roughly in the plane of

the top of the tray 3. In the case of a package having either the lid 4 or the lid 24, it is sufficient for the gas pressure within the package to decrease to the ambient pressure and to allow the lid to fall back towards the food product 1, but in the case of a package having the lid 14, it is necessary for the gas pressure within the package to decrease below the ambient pressure so that the lid 14 is caused by the pressure difference across it to move down towards the food product. As the food product 1 is now baked and may have a crust on its upper surface, any contact between the inner surface of the lid 4 and the food product is less likely to spoil the appearance of the food product or cause other undesirable effects.

Referring to Fig. 8, instead of sealing the package 2 using a sealing layer in the form of a flexible sheet material, a sealing layer 8 in the form of a sheet of semi-rigid plastics or board can be sealed to the lid 4 over an area surrounding the apertures 5 to seal the package before the tray 3 is removed from the oven. After cooling, when the lid 4 has moved down towards the tray 3, the sealing layer 8 can then be affixed to the tray 3 as shown in Fig. 8.

In another sealing arrangement (not shown), the tray 3 can be removed from the oven and the lid 4 allowed to move down towards the tray before sealing. The apertures 5 and the microporous patch 6 are then covered with a sealing layer (not shown) which is affixed to the lid 4

or the tray 3. Such a sealing layer incoporates an antimycotic agent to guard against re-contamination by vegetative micro-organisms. Immediately prior to sealing, the surface of the lid 4 and the microporous patch 6 to be contacted by the sealing layer may be heated to a temperature of at least 80°C, and/or treated with ultra-violet radiation, in order to inhibit germination of any mould spores that may have fallen on that surface during cooling. The sealing layer may also be heated prior to use.

Turning now to Figs. 9 to 11, a tray indicated generally by the reference numeral 30 is a unit of multi-cavity configuration, that is to say, it has a plurality of cavities 30a for food product 31. As shown in Fig. 9, the tray 30 is placed on a sheet 32a of flexible material, which is folded over the top of the tray 30. Peripheral portions 32b of the sheet 32a are then heat-sealed together around three sides to form a pouch, indicated generally by the reference numeral 32, which covers the mouths of the cavities 30a. The pouch 32 is provided with a microporous window which comprises a regular array of circular apertures 33, similar to the apertures 5 in the lid 4 shown in Fig. 2, and a microporous patch 34, similar to the patch 6, affixed by heat-sealing to the outer surface of the pouch 32 to close the apertures 33. As shown in Fig. 9, the window is located underneath the tray 30. Gases can only enter or leave the pouch 32 through the apertures 33 and the patch 34, and micro-

organisms on the exterior are substantially prevented from entering and reaching the food product 31. The tray 30 containing the food product 31 and the pouch 32 is placed in an oven and heated to effect pasteurisation of, and to bake, the food product. As in the process described with reference to Figs. 1 to 8, gases (principally water vapour) are given off by the food product 31 and those gases together with an increase in pressure as a result of heating of the atmosphere within the pouch 32 cause the portion of the pouch above the food product to rise away from the tray 30 and form a dome over the mouths of the cavities 30a allowing room for the food product to expand without contacting the inner surface of the pouch.

The tray 30 is then removed from the oven and its contents allowed to cool whereupon the pouch 32 falls back towards the tray. A sealing layer 35 of moisture-impermeable material, which incorporates an antimycotic agent, is then placed over the microporous patch 34 and heat-sealed to the outer surface of the pouch 32.

As an alternative to using the sealing layer 35, the pouch 32 with its contents may be enclosed within an over-wrap (not shown) which is then sealed.

Referring to Fig. 12, in a modification of the arrangement shown in Figs. 9 to 11, a tray 40 with cavities 40a containing food product 41 is placed within a pouch, indicated generally by the reference numeral 42, which is formed from a sheet of flexible material heat-

sealed around three sides at 42a, 42b and 42c, respectively. The pouch 42 has a microporous window with apertures 43 and covering microporous patch 44 but they are not located beneath the tray 40, but to one side. During baking, the portion of the pouch 42 that is above the mouths of the cavities 40a and the regions of the tray 40 separating the cavities, is caused to rise sufficiently far away from the tray 40 to allow the food product 41 to increase in volume without coming into contact with the pouch 42. After cooling, a sealing layer similar to the sealing layer 35 of Fig. 11 need not be applied but, instead, opposing surfaces of the pouch 42 can be sealed together at 42d. The tray 40 and its food product 41 are then completely sealed within the pouch 42. The portion of the pouch containing the apertures 43 and the microporous patch 44 can be cut away. If desired, instead or in addition to sealing the pouch 42 at 42d, the pouch may be heat-sealed to the tray 40 at 42e (see Fig. 13) around each of the cavities 40a, and the tray 40 may also be formed with lines of weakness indicated by broken lines 45 around each of the cavities 40a, so that portions of the tray, each containing a cavity 40a can be separated easily from each other.

It will be appreciated that the thicknesses of the tray 3, the lids 4, 14 and 24, the pouch 32, the microporous patches 6, 16, 26 and 34, and the sealing layers 7, 8 and 35 are all shown exaggerated in Figs. 1 to 9 in order to show the construction of the packages

clearly.

The tray 3 may be given the desired configuration by moulding, thermo-forming or pressure-forming. In the last case, the tray 3 may be formed by placing a relatively thin sheet, for example, within the range of from 20 to 30 x 10^{-6}m, of co-extruded oriented polyester and heat-sealable amorphous polyester on a male die with the amorphous layer in contact with the die, and then placing the sheet and the male die in a matching female die so as to pleat or crease the sheet into the desired configuration of the tray. By using heated dies, the pleats can be secured in place by heat-sealing the layers of the pleats together. Instead of using a single sheet of co-extruded material, two such sheets affixed to each other by means of a temperature-resistant adhesive with their amorphous surfaces outermost may be used so that better heat-sealing of the pleats can be obtained. When the tray 3 is formed in the above manner, because it may be lacking in rigidity, it is preferably located in a rigid container during baking.

Claims:

1. A process for preserving a food product that increases in volume when heated, which comprises enclosing the food product in a package comprising a tray, in which the food product is located, and a cover of flexible material arranged over the mouth of the tray and spaced apart from the food product, the package having a microporous window (as hereinbefore defined), heating the food product in the package to effect pasteurisation and, if desired, cooking, of the food product, and sealing the package, the cover and the microporous window being so arranged, and of such an area, relative to the tray and the food product that, before the package is sealed, gas can only enter or leave the interior of the package through the microporous window and, during heating, in spite of an increase in volume of the food product, the cover remains spaced apart from the food product and, during subsequent cooling, moves towards the food product.

2. A process as claimed in claim 1, wherein the microporous window comprises a single opening or two or more openings in the cover or the tray and a patch of microporous material closing the opening or openings, the openings being much larger than the pores in the micro-porous material.

3. A process as claimed in claim 1, wherein the microporous window is a region of the cover or the tray that has perforations in it of such a size that gases can

pass through the window but micro-organisms are substantially prevented from doing so.

4. A process as claimed in any one of claims 1 to 3, wherein the cover is affixed to the tray itself round the mouth of the tray, the part of the cover bounded by its join to the tray being of greater area than the mouth of the tray, and constituting a lid.

5. A process as claimed in claim 4, wherein the lid is affixed mechanically to the tray.

6. A process as claimed in claim 4, wherein the lid is affixed to the tray by heat-sealing.

7. A process as claimed in any one of claims 4 to 6, wherein the lid is so arranged that it extends down into the tray before heating (although it is spaced apart from the food product) and, during heating, rises to form a dome over the food product.

8. A process as claimed in any one of claims 4 to 6, wherein the lid is folded, pleated, or preformed and collapsed, so that it lies substantially in the plane of the top of the tray before heating and, during heating, rises to form a dome over the food product.

9. A process as claimed in any one of claims 4 to 6, wherein the cover is of generally domed configuration before heating.

10. A process as claimed in any one of claims 4 to 9, wherein the package is sealed before any substantial cooling of the food product has occurred by placing over the window a sealing layer of moisture-impermeable

material (as hereinbefore defined) and affixing the sealing layer.

11. A process as claimed in claim 10, wherein the window is located in the lid and the porosity and the area of the window, the nature of the food product and the baking temperature are such that, at or before the completion of the heating step, the lid is, over an area that includes the window, upheld with sufficient force by the excess gas pressure within the package over the ambient pressure to enable the sealing layer to be affixed to the lid by pressing the sealing layer downwards on the lid without causing the lid to come into contact with the food product.

12. A process as claimed in claim 10 or cliam 11, wherein the microporous window is in the lid and the sealing layer is sealed to the lid over an area surrounding the window before any substantial cooling of the food product has occurred, and the said layer is affixed to the tray, or to the lid where it is supported by the tray, after cooling, when the lid has moved towards the food product.

13. A process as claimed in claim 12, wherein the sealing layer is a sheet of semi-rigid plastics material.

14. A process as claimed in claim 12, wherein the sealing layer is a board.

15. A process as claimed in any one of claims 4 to 9, wherein the food product is allowed to cool and the package sealed after the flexible lid has moved towards

the food product by placing over the microporous window a sealing layer of moisture-impermeable material at that stage and then affixing the sealing layer to the lid and/or tray.

16. A process as claimed in claim 15, wherein the sealing layer is in the form of a sheet of semi-rigid plastics or board.

17. A process as claimed in claim 15 or claim 16, wherein the sealing layer has incorporated in it an antimycotic agent.

18. A process as claimed in any one of claims 15 to 17, wherein, immediately prior to sealing, the surfaces of the lid and/or tray and the microporous window that are to be contacted by the sealing layer are heated to a temperature of at least 80°C.

19. A process as claimed in claim 18, wherein the sealing layer is also heated prior to use.

20. A process as claimed in any one of claims 4 to 19, wherein sealing is carried out by placing the tray with its contents and lid in a moisture-impermeable overwrap.

21. A process as claimed in any one of claims 4 to 20, wherein, when the food product has finished cooling, the lid lies substantially in the plane of the top of the tray.

22. A process as claimed in any one of claims 1 to 21, wherein the tray is of such configuration that it has a base and side walls (as hereinbefore defined) that

extend round the base of the tray, the food product being placed on the base of the tray.

23. A process as claimed in any one of claims 1 to 21, wherein the tray is of such configuration that it defines a plurality of cavities for the food product.

24. A process as claimed in any one of claims 1, 22 and 23, wherein the cover is a pouch in which the tray is situated, the microporous window being located in the pouch.

25. A process as claimed in claim 24, wherein, after the food product has cooled, the microporous window is covered by a sealing layer of moisture-impermeable material which is affixed to the pouch to seal it.

26. A process as claimed in claim 24, wherein, after the food product has cooled, the pouch is enclosed in an over-wrap of moisture-impermeable material, which is then sealed.

27. A process as claimed in any one of claims 24 to 26, wherein the microporous window is so located in the pouch that it is underneath the tray.

28. A process as claimed in any one of claims 24 to 26, wherein the microporous window is so located in the pouch relative to the tray that opposing surfaces of the pouch can be affixed to each other to isolate the food product from the microporous window, and thereby seal the tray in a moisture-impermeable enclosure provided by a portion of the pouch.

29. A process as claimed in claim 28, wherein,

after sealing, the portion of the pouch containing the microporous window is removed.

30. A process as claimed in any one of claims 27 to 29, wherein the tray defines a plurality of cavities and the pouch is sealed to the tray around the mouth of each of the cavities.

31. A process as claimed in claim 30, wherein the tray is formed with lines of weakness around each of the cavities so as to allow portions of the tray, each comprising one of the cavities, to be separated easily from each other.

32. A process as claimed in any one of claims 1 to 31, wherein the tray is formed by placing a relatively thin sheet of co-extruded oriented polyester and heat-sealable amorphous polyester on a male die, and placing the sheet and the male die in a matching female die so as to pleat or crease the sheet into the desired configuration.

33. A process as claimed in claim 32, wherein the dies are heated and the pleats are secured in place by heat-sealing the layers of the pleats together.

34. A process as claimed in claim 32 or claim 33, wherein, before the sheet is placed in the male die, a second sheet of co-extruded oriented polyester and heat-sealable amorphous polyester is affixed to the first sheet by means of a temperature-resistant adhesive, the sheets having their amorphous surfaces outermost.

35. A process as claimed in any one of claims 32 to

34, wherein the tray is located in a rigid container during the heating of the food product.

36. A process for preserving a food product substantially as hereinbefore described with reference to Figs. 1 to 8 of the accompanying drawings.

37. A process for preserving a food product substantially as hereinbefore described with reference to Figs. 9 to 11 of the accompanying drawings, or with reference to Fig. 12 or Fig. 13 of the accompanying drawings.

38. A sealed package containing a food product which has been preserved by a process as claimed in any one of claims 1 to 37.

39. A sealed package containing a food product substantially as hereinbefore described with reference to, and as shown in, Figs. 1 to 3, and 6 to 8 of the accompanying drawings, or modified as shown in Fig. 4 or Fig. 5.

40. A sealed package containing a food product substantially as hereinbefore described with reference to, and as shown in, Figs. 9 to 11 of the accompanying drawings, or with reference to Fig. 12 or Fig. 13 of the accompanying drawings.

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(i) UK Cl (Edition K) A2D (DPL, DSX, DX2, DX3)
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(ii) Int Cl (Edition 5) A23L; B65B; B65D

Databases (see over)

(i) UK Patent Office

(ii)

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Documents considered relevant following a search in respect of claims 1-40

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	EP A2 0368601 (UNITED BISCUITS)	at least Claim 1
X	EP A2 0261929 (KEYES) Claims 1-4; figure 3; page 1, lines 43-47	"

SF2(p)

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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